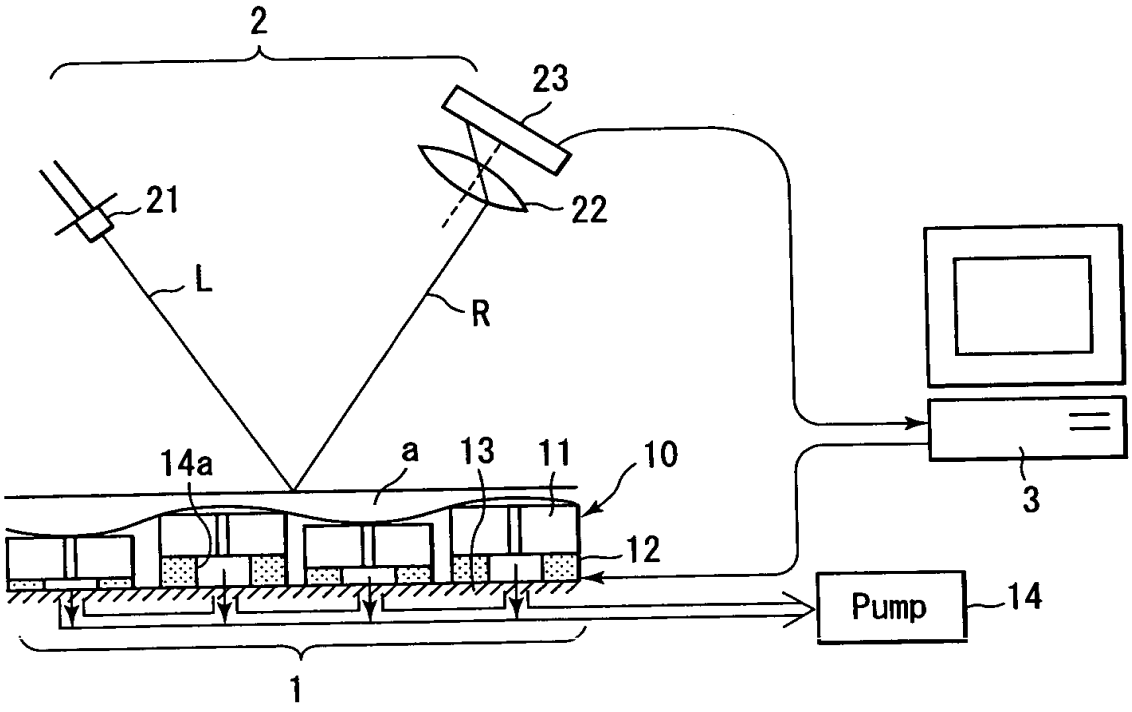

FIG. 1

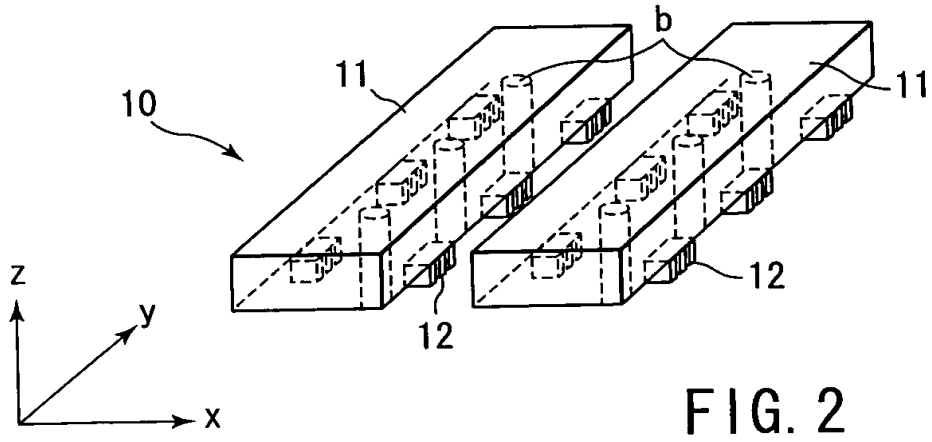

FIG. 2

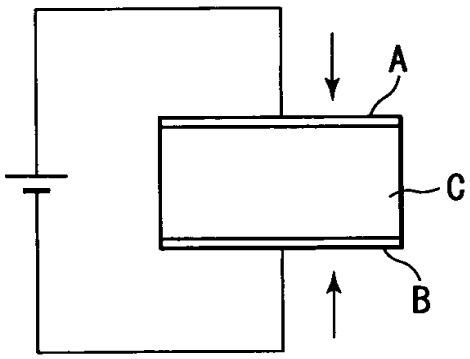

FIG. 3A

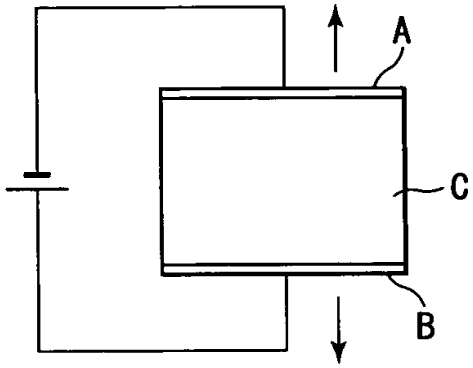

FIG. 3B

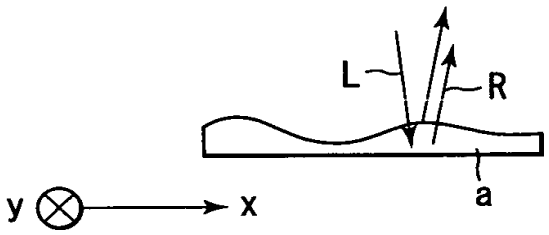

FIG. 4A

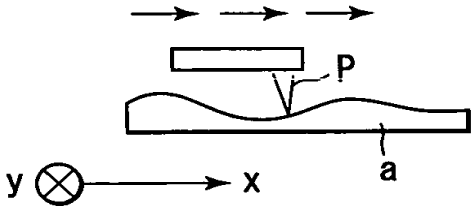

FIG. 4B

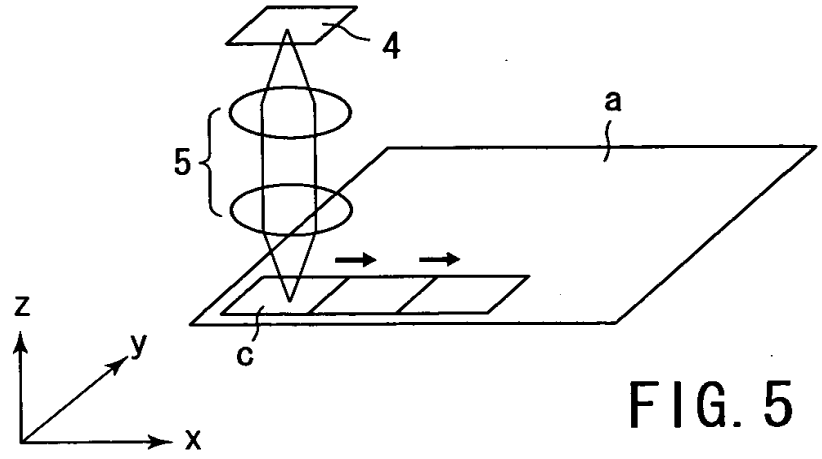

FIG. 5

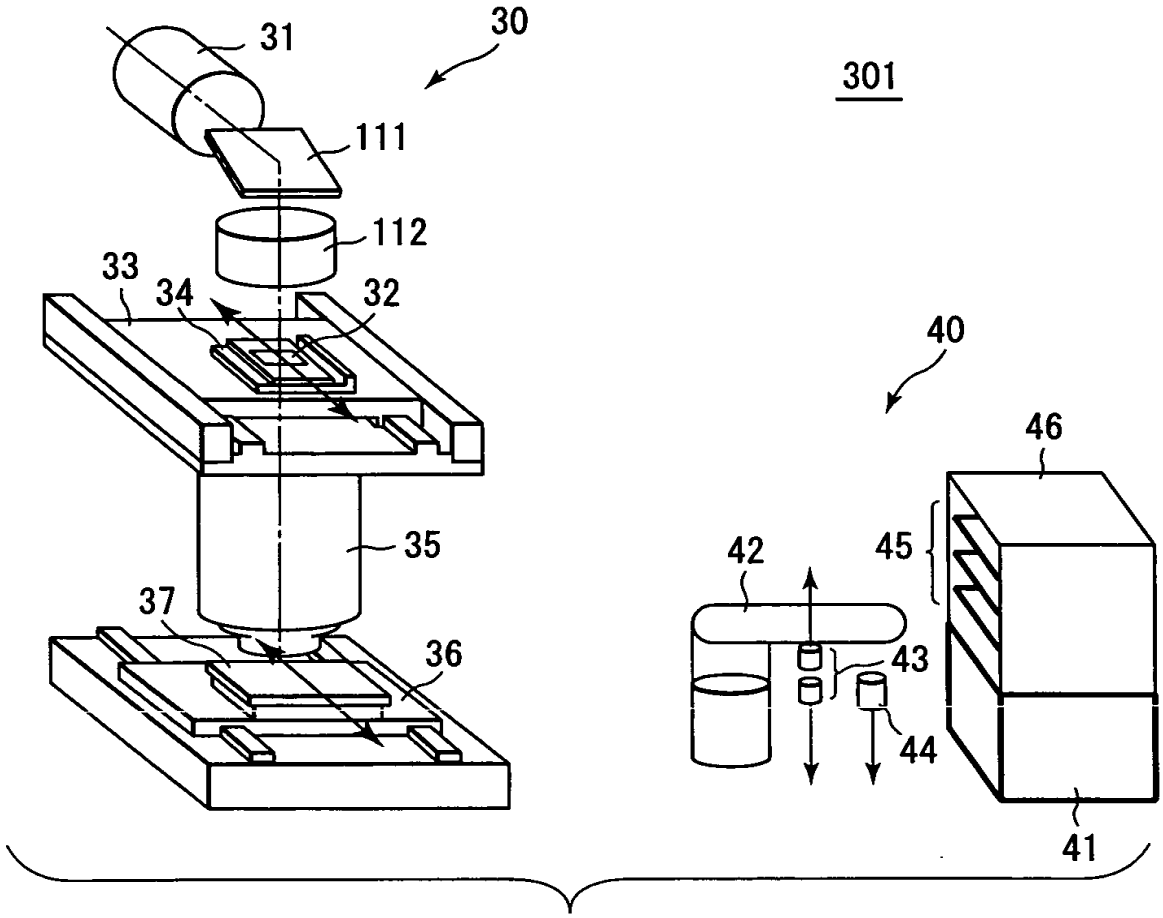

FIG. 6

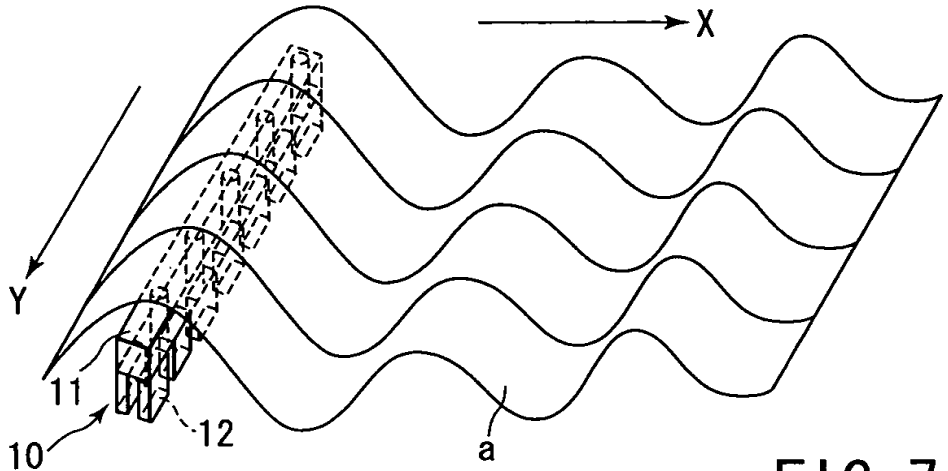

FIG. 7

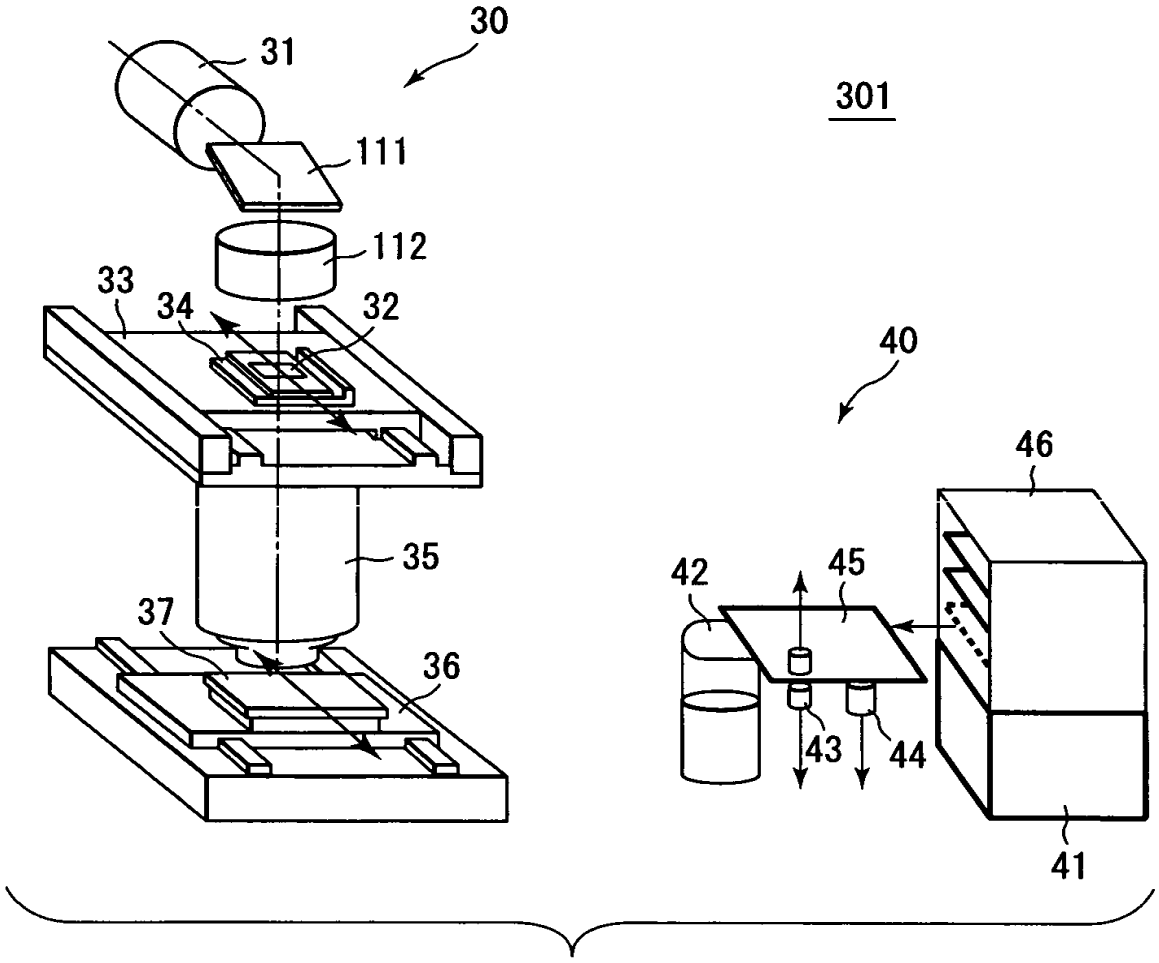

FIG. 8

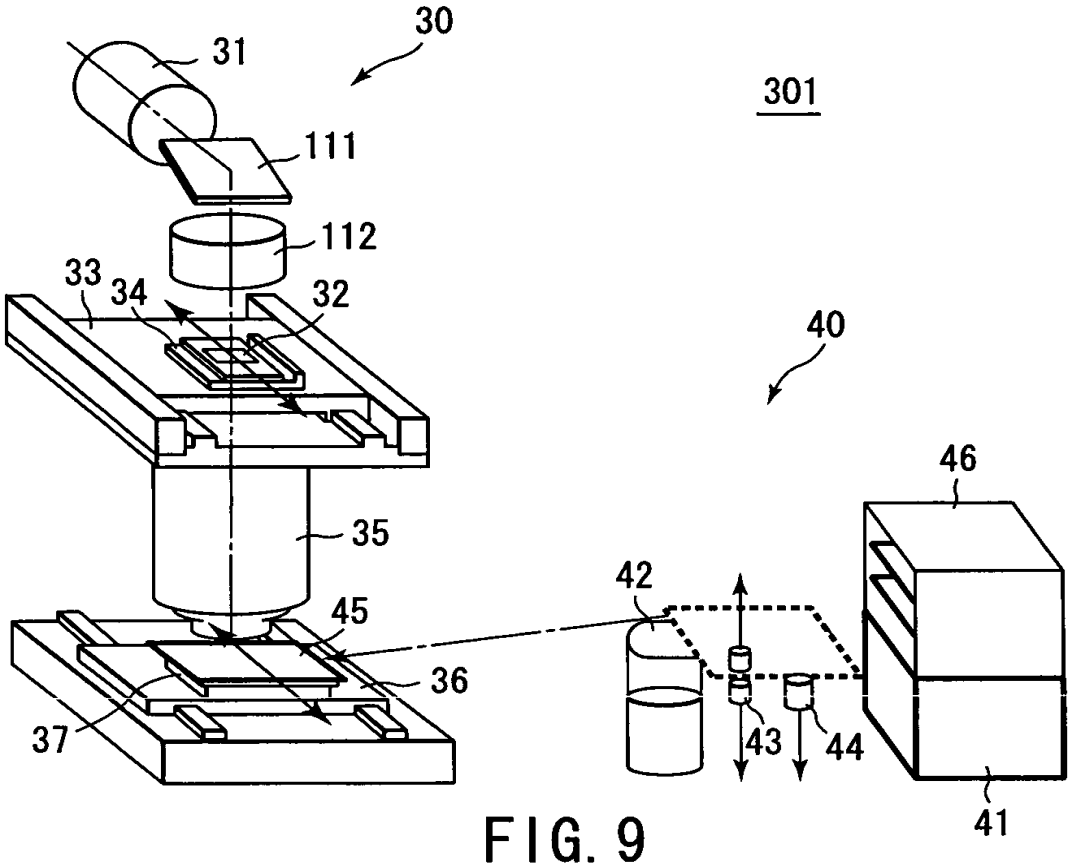
30
31
301
111
112
33
34
32
40
46
35
42
45
36
37
43
44
41

FIG. 9

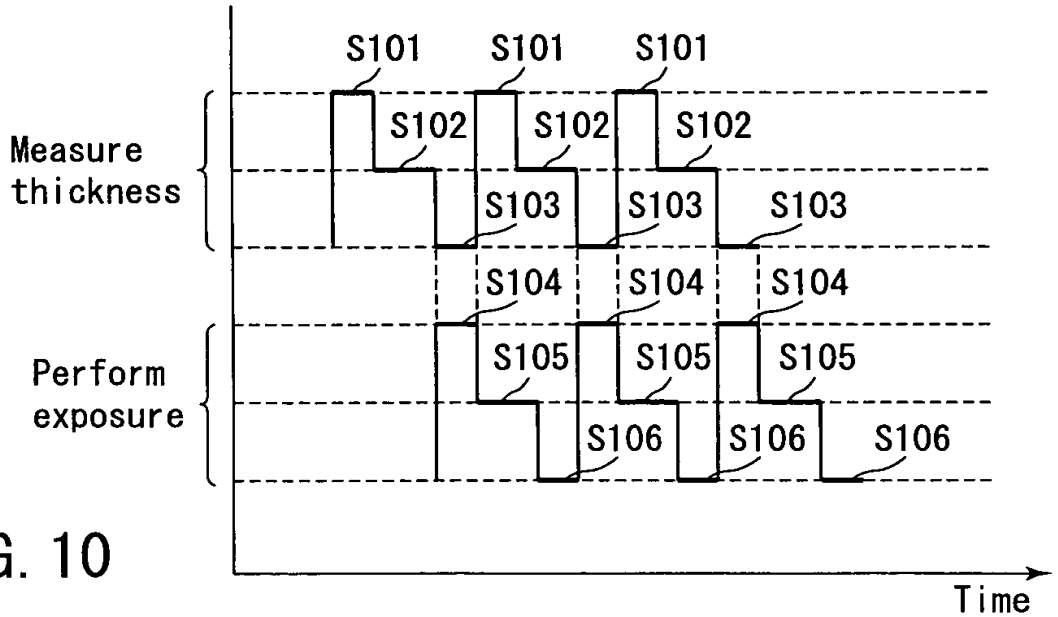
S101
S101
S101
Measure thickness
S102
S102
S102
S103
S103
S103
S104
S104
S104
Perform exposure
S105
S105
S105
S106
S106
S106
Time

FIG. 10

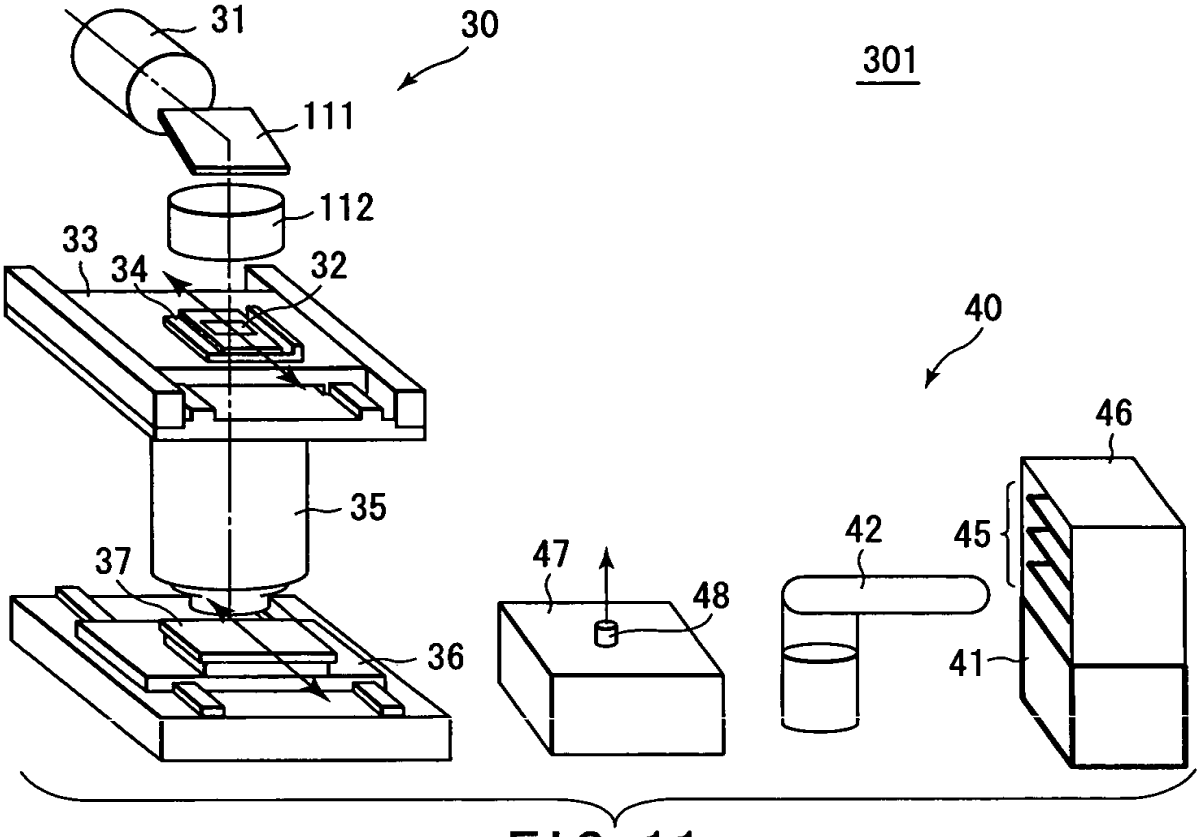
31
30
301
111
112
33
34
32
40
46
35
42
45
47
48
37
36
41

FIG. 11

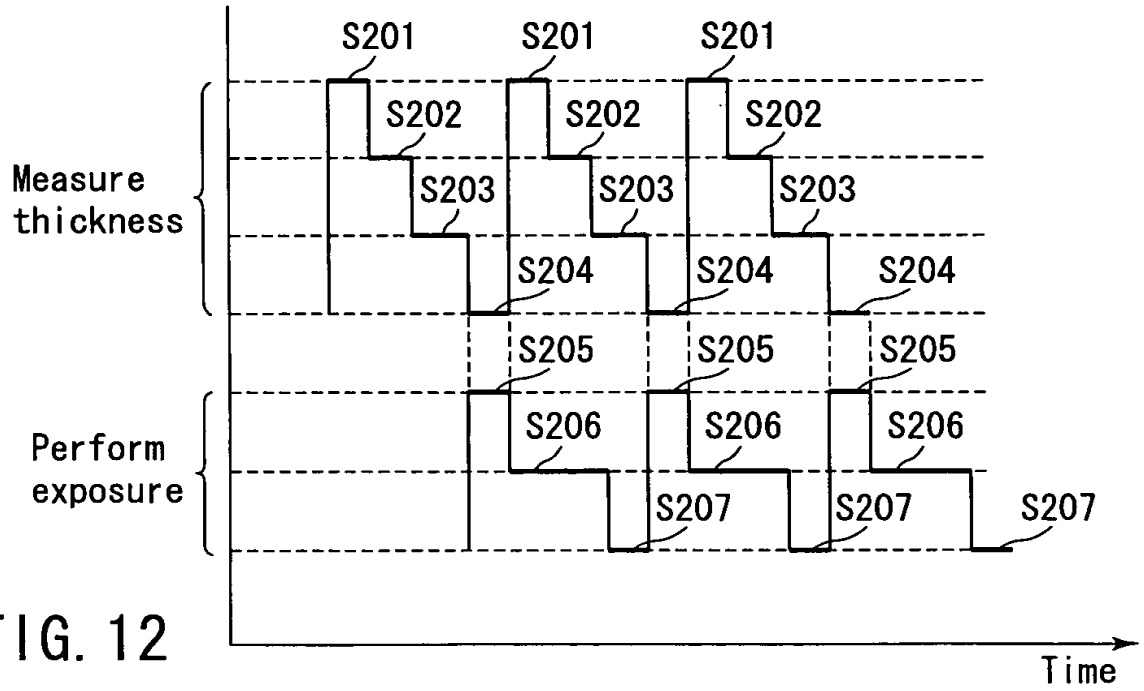
S201
S201
S201
S202
S202
S202
Measure thickness
S203
S203
S203
S204
S204
S204
S205
S205
S205
S206
S206
S206
Perform exposure
S207
S207
S207
Time

FIG. 12

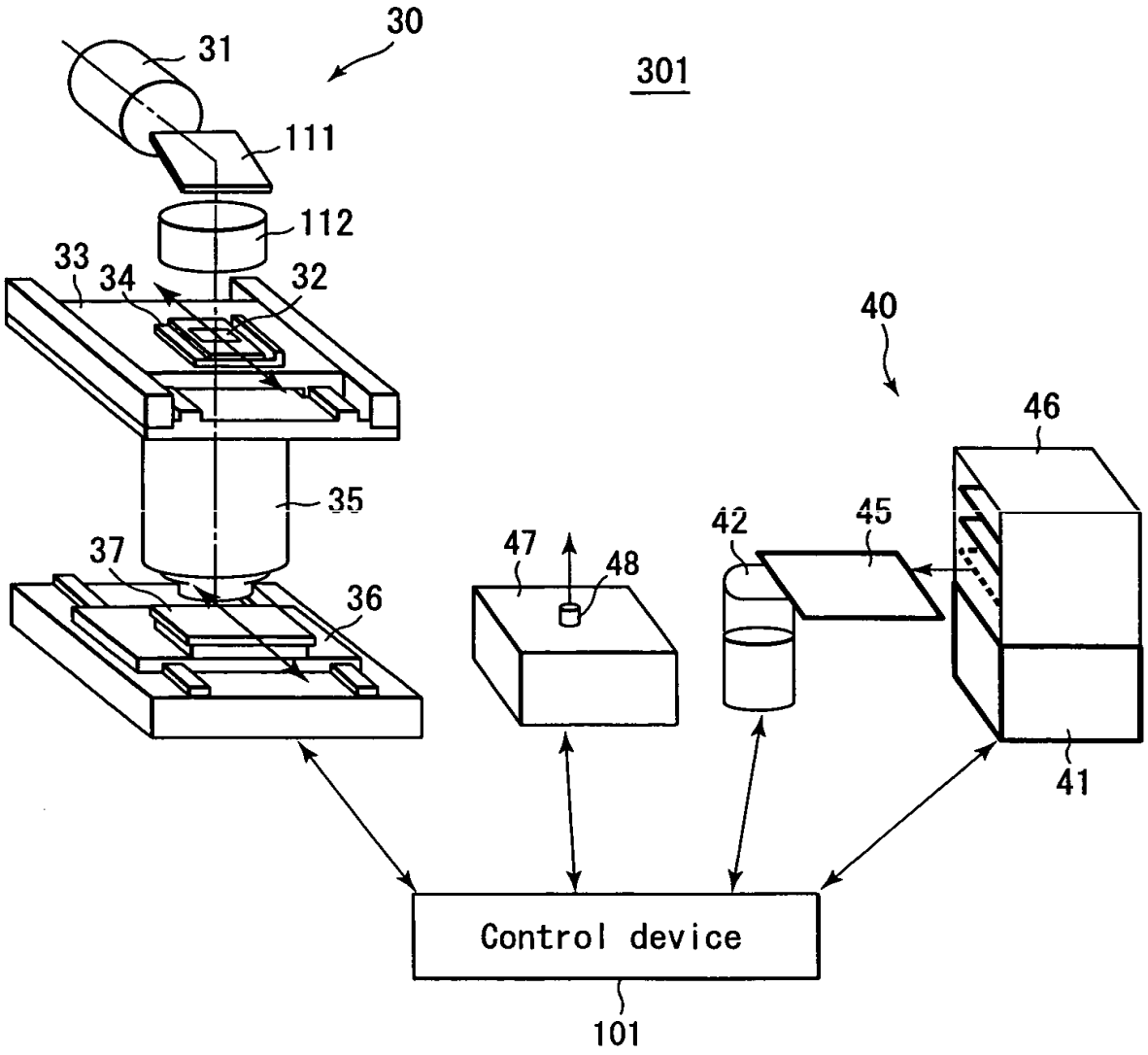
30
31
301
111
112
33
34
32
40
46
35
42
45
47
48
37
36
41
Control device
101

FIG. 13

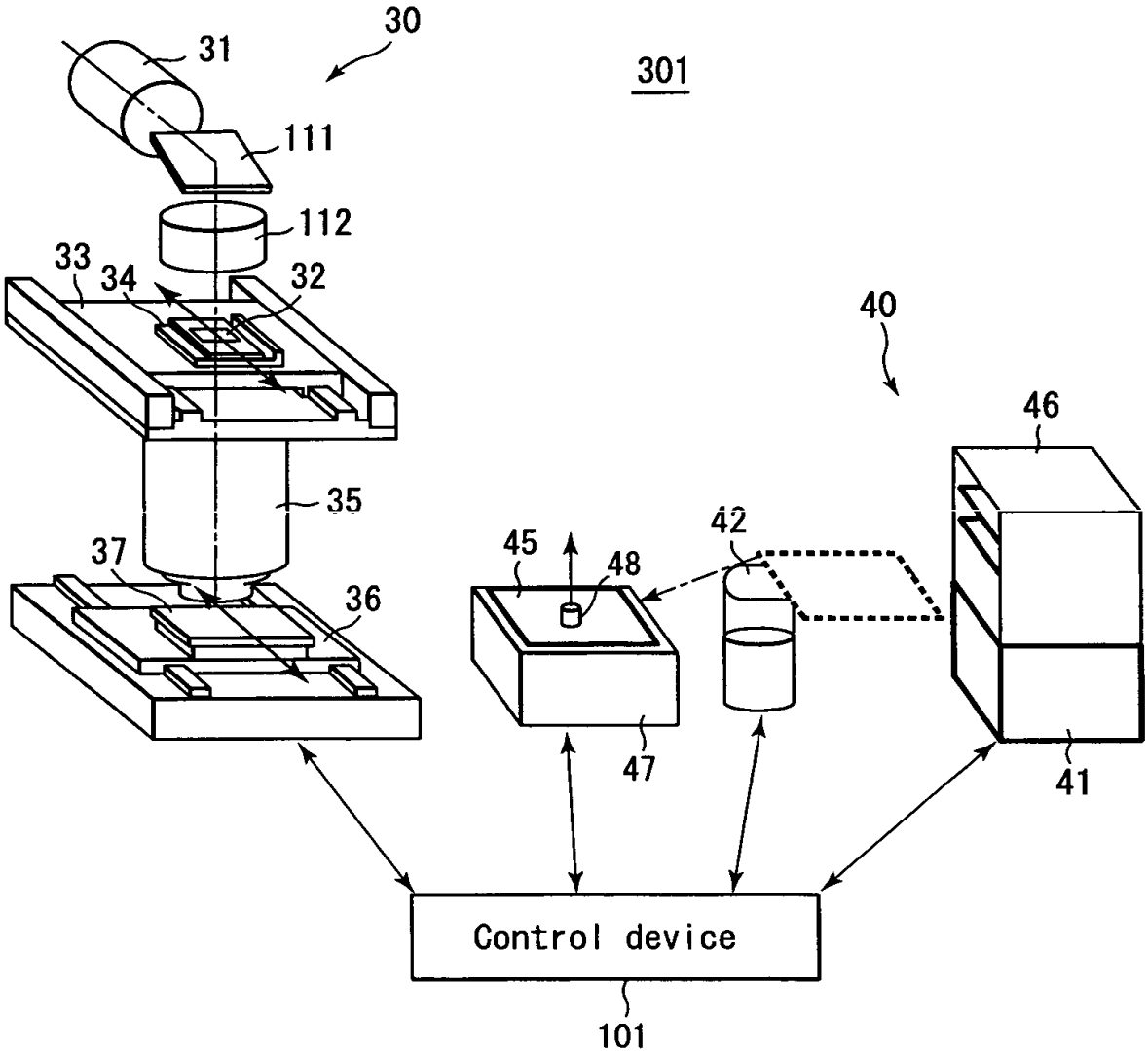
30
31
301
111
112
33
34
32
40
46
35
42
45
48
37
36
47
41
Control device
101

FIG. 14

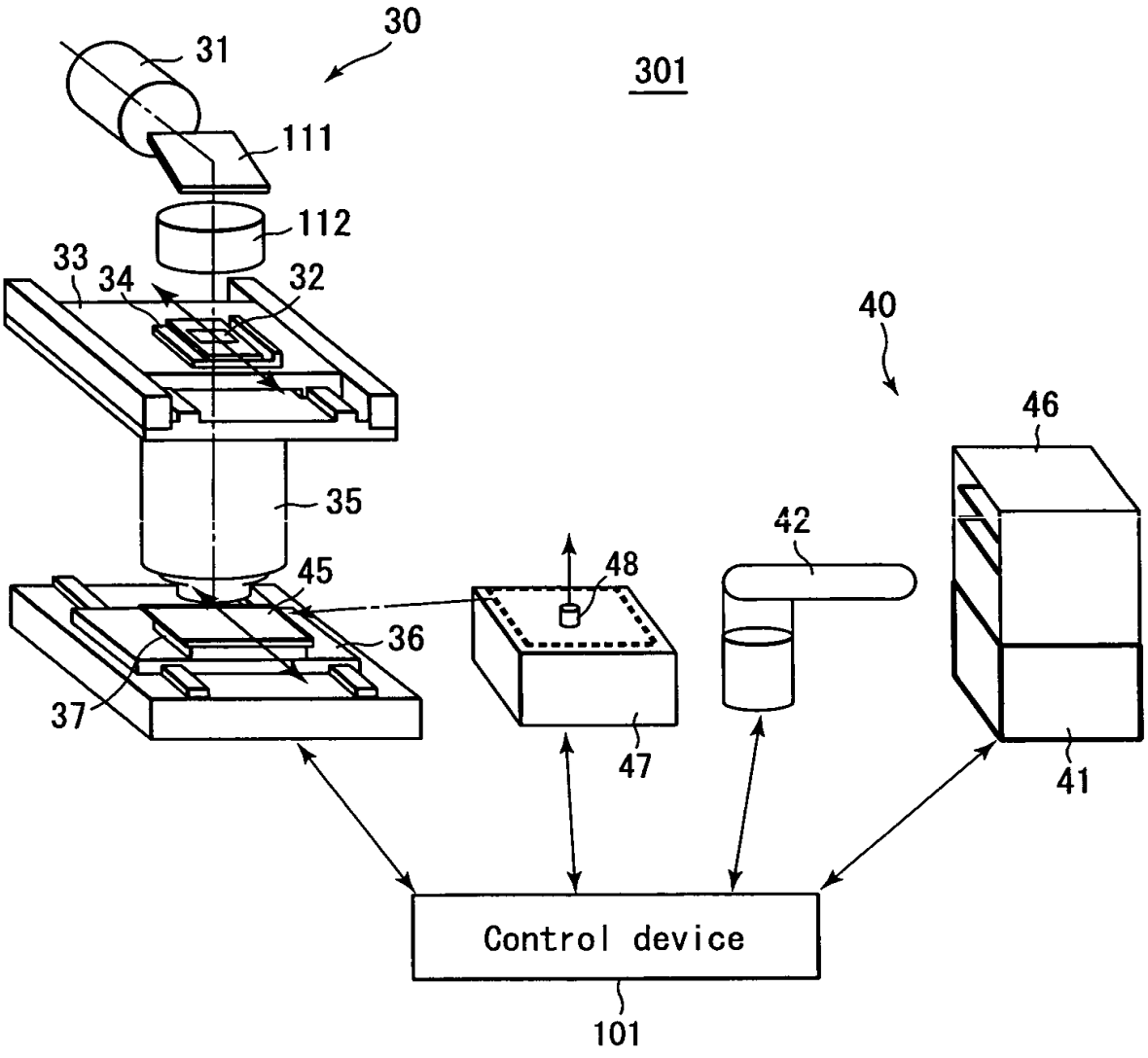
30
31
301
111
112
33
34
32
40
46
35
42
48
45
36
37
47
41
Control device
101

FIG. 15

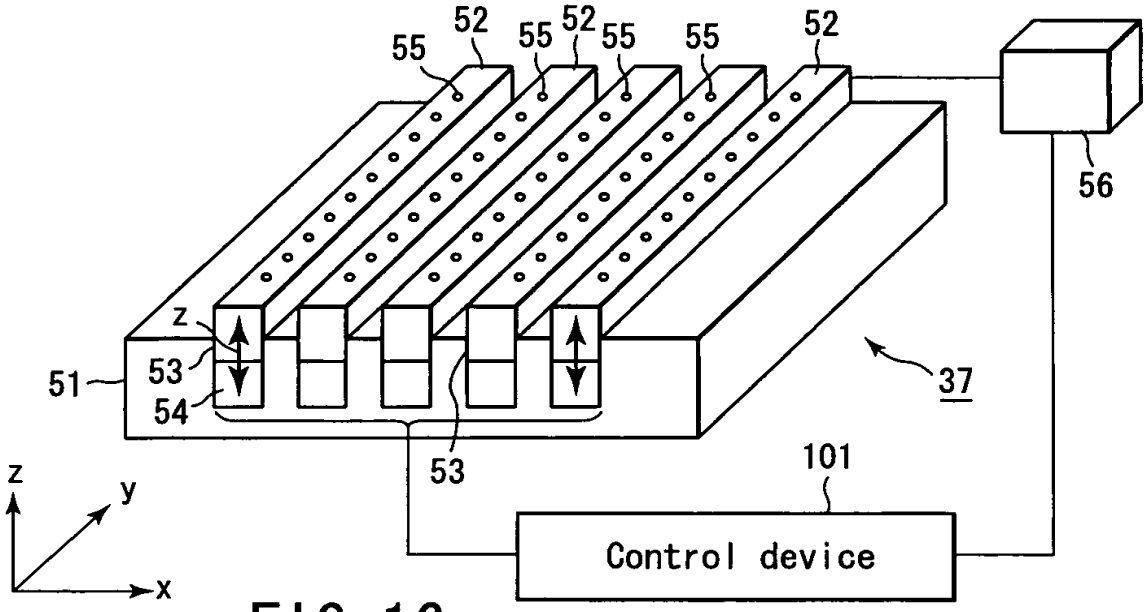
55
52
55
52
55
55
52
56
z
53
54
51
53
37
101
Control device
z
y
x

FIG. 16

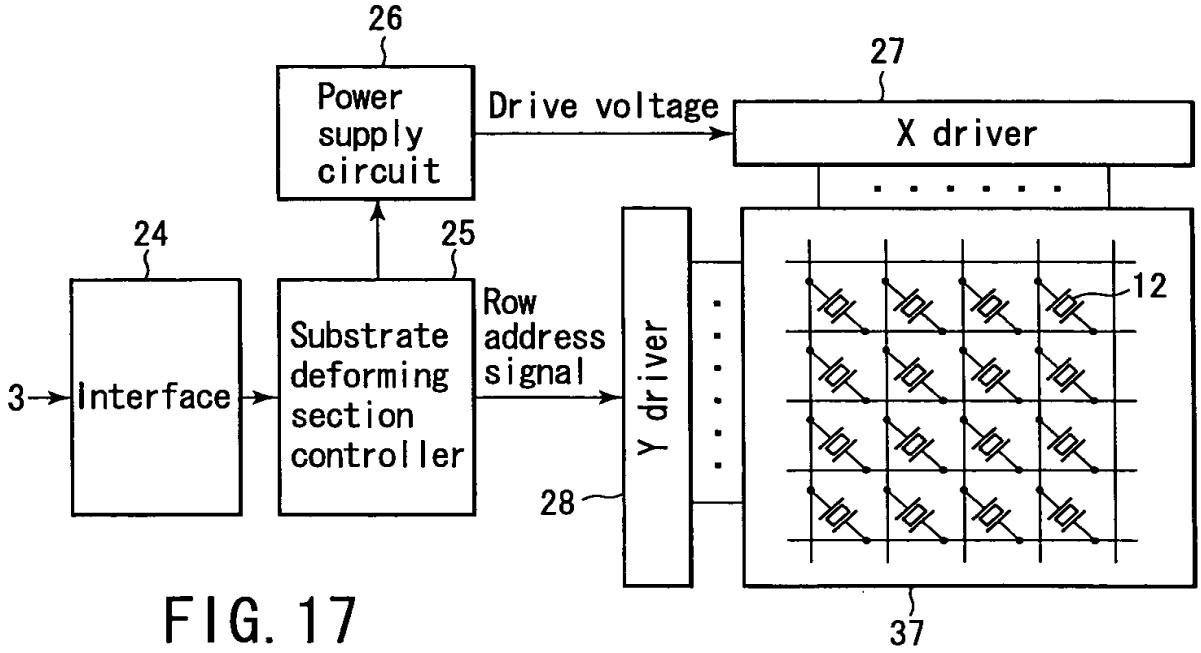
26
Power supply circuit
Drive voltage
27
X driver
24
25
Row address signal
12
3
Interface
Substrate deforming section controller
Y driver
28
37

FIG. 17

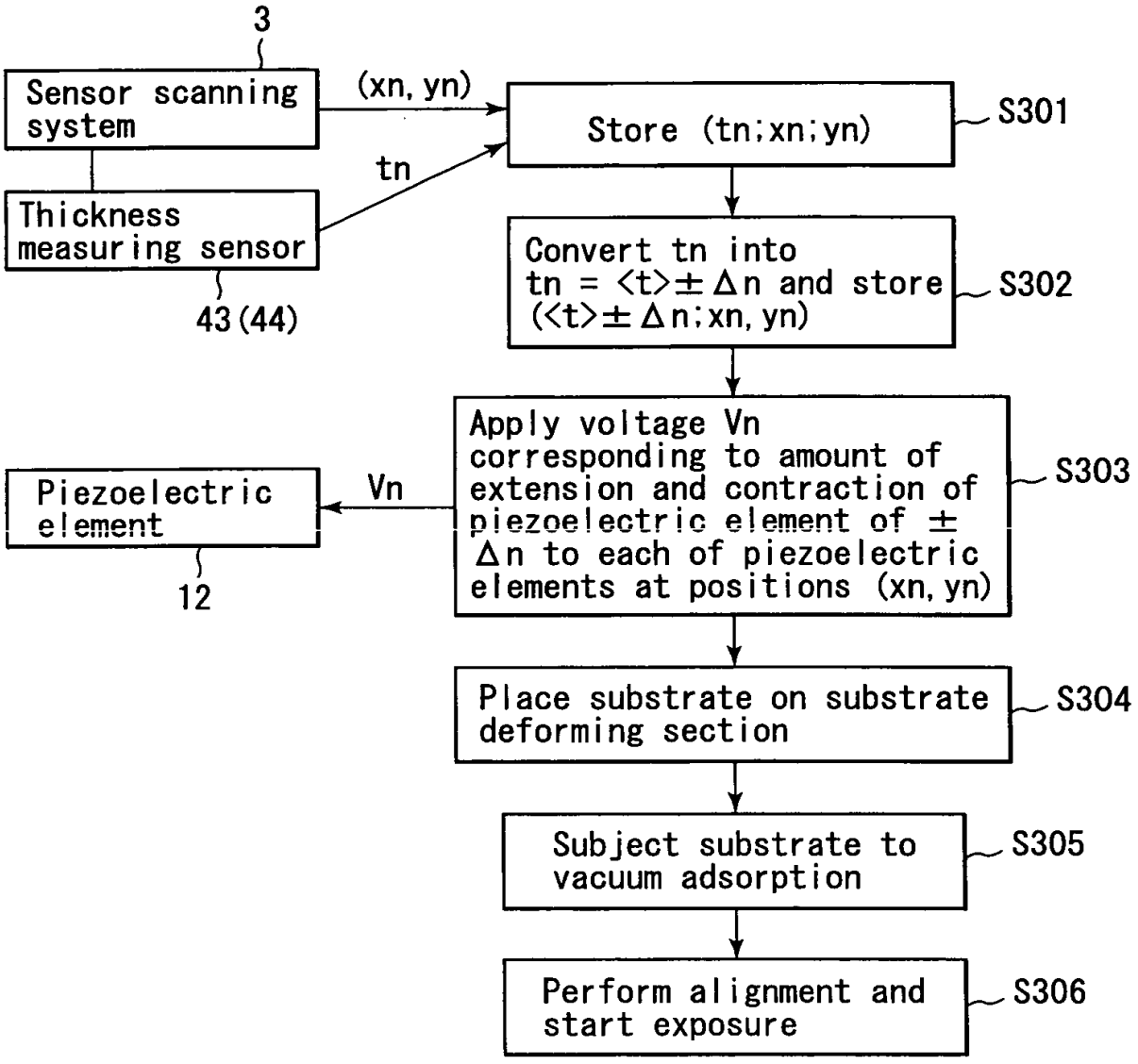
3
Sensor scanning system
(xn, yn)
Store (tn;xn;yn)
S301
tn
Thickness measuring sensor
43 (44)
Convert tn into tn = <t> ± Δn and store (<t> ± Δn;xn, yn)
S302
Apply voltage Vn corresponding to amount of extension and contraction of piezoelectric element of ± Δn to each of piezoelectric elements at positions (xn, yn)
S303
Vn
Piezoelectric element
12
Place substrate on substrate deforming section
S304
Subject substrate to vacuum adsorption
S305
Perform alignment and start exposure
S306

FIG. 18

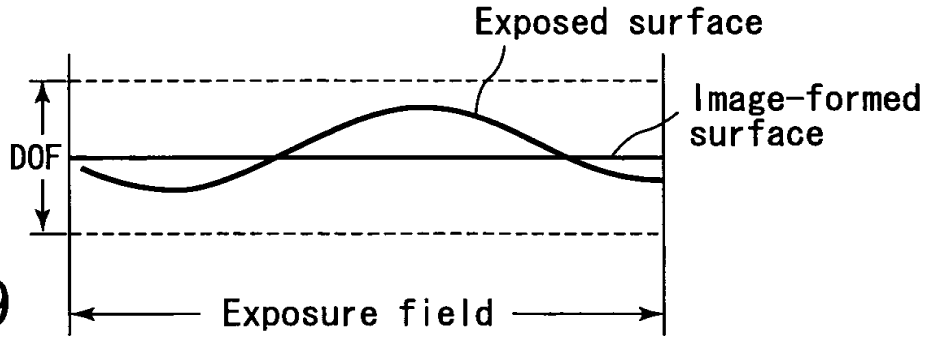
Exposed surface
Image-formed surface
DOF
Exposure field

FIG. 19

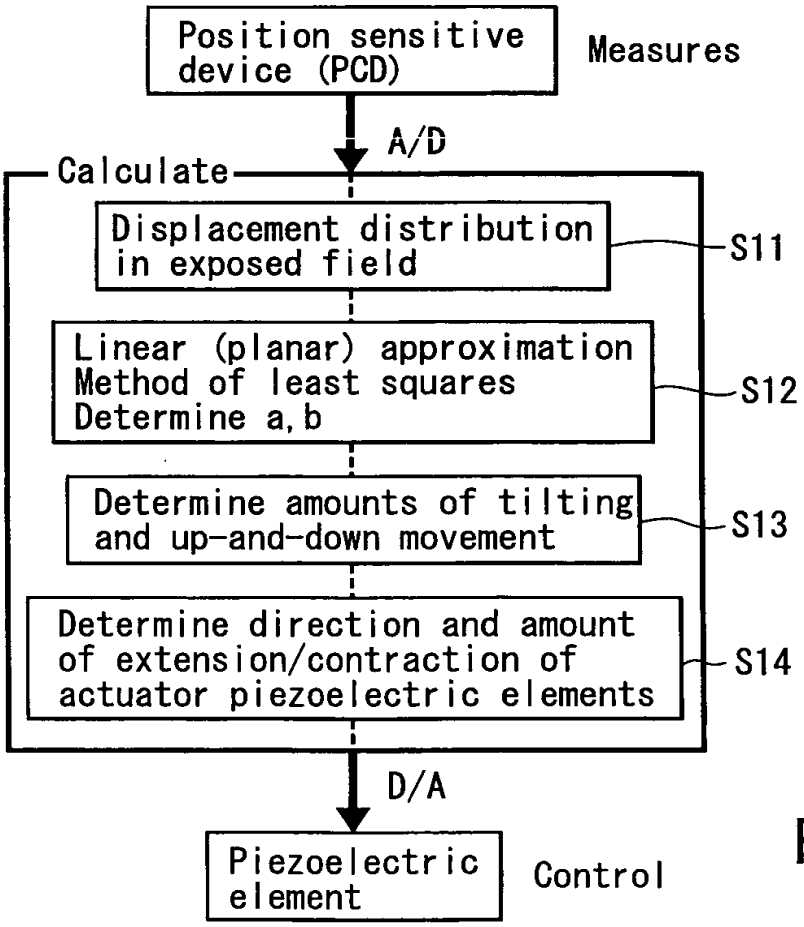
Position sensitive device (PCD)
Measures
A/D
Calculate
Displacement distribution in exposed field
S11
Linear (planar) approximation
Method of least squares
Determine a, b
S12
Determine amounts of tilting and up-and-down movement
S13
Determine direction and amount of extension/contraction of actuator piezoelectric elements
S14
D/A
Piezoelectric element
Control

FIG. 20

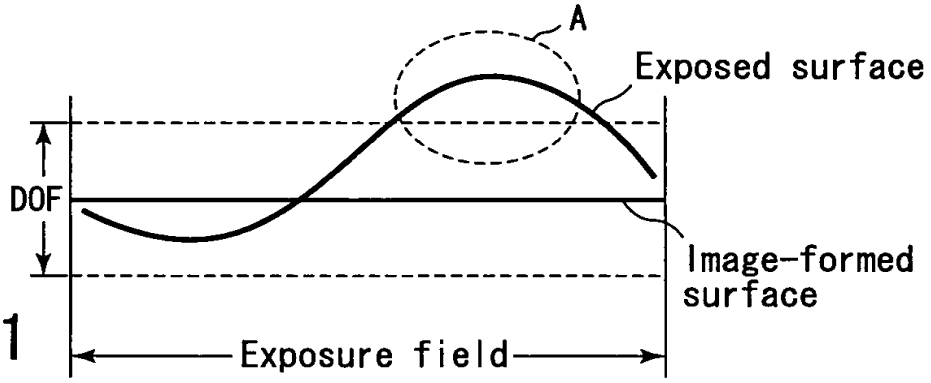

FIG. 21

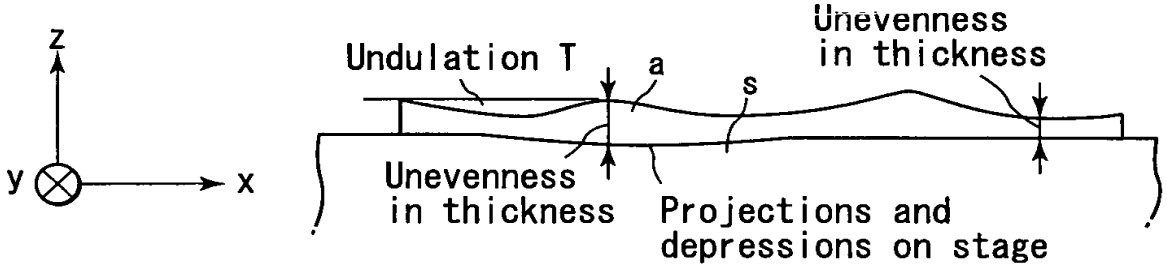

FIG. 22

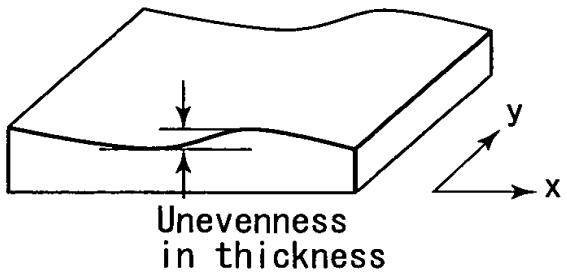

FIG. 23